SPECIFICATION

TITLE OF THE INVENTION

SLEEVE FOR PRESS ROLL AND SLEEVE MOUNTED PRESS ROLL

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a sleeve, which is a cylindrical structure formed like a paper pipe, for externally mounting on a press roll, especially a press roll of a corrugator, and also relates to a press roll mounted with said sleeve.

Description of the Conventional Art

When a corrugated cardboard is manufactured by using the corrugator, which is a corrugated cardboard manufacturing device, the method used is such that a corrugating medium is fed to a pair of corrugation rolls meshing each other to carry out a corrugation process, the ridge of the corrugated medium is pasted, a liner fed from the another side is contacted with the pasted corrugated medium, said corrugated medium and liner are passed between the corrugation roll and the press roll, and said corrugated medium is thus bonded with the liner (refer to Figure 8 described below).

In many cases, a pair of corrugation rolls are arranged perpendicularly or slantingly up and low, and there are two arrangements of the press roll, i.e., at the side of the upper corrugation roll or the lower corrugation roll. In addition, two press rolls are arranged occasionally at the feeding paper side and the discharging paper side.

Both of the corrugation roll and press roll of the corrugator are made with a metal and it is available that the diameters of the corrugation roll and the press roll are about same or different.

The corrugation roll and the press roll are arranged oppositely with a small space being kept. At this time, an idea for adjusting the space between the corrugation roll and the press roll has been proposed. That is, in the Japanese Patent Laid-Open No. 207294 — 1997 (Patent document 1), the technique for enhancing the simplification and efficiency of the work by setting each space between the corrugation roll and the press roll according to the combination of the corrugating medium and the liner, is described. In the Japanese Patent Laid-Open No. 52824 — 1996 (Patent document 2), the technique similar to the patent document 1 is described.

The corrugation roll and press roll of the

corrugator has been used under very severe conditions, i.e., at the high temperature, high rotational speed and large vibration.

Therefore, since the corrugation roll and press roll of the corrugator are made with the metal, it is impossible to prevent that a considerable vibration and noise are generated by collision or shock of metals, which is caused from the vibration and high rotational speed at the time of being driven although the corrugated medium and the liner are interposed between the rolls. Furthermore, a pressed stripe, which is called to as a press mark, is marked easily on the liner surface of the corrugated cardboard. Moreover, both of the corrugation roll and the press roll are damaged easily, and especially, the damage of the corrugation roll side is restored hardly, so that the life of the corrugation roll at the side contacting with the press roll is limited naturally.

As described in the patent documents 1 and 2, the technique for adjusting the space between the corrugation roll and the press roll aimed to solve these problems, but it is hard to avoid the complication of the device and a control mechanism.

As for another problem at the time of producing the corrugated cardboard by the corrugator, since the

bonding of the corrugated medium with the liner is carried out by linear contact, the time of pressing them is very short. So, in order to bond the corrugating medium with the liner certainly, there is a restriction to increase the speed for producing the corrugated cardboard to more than a certain limit. Therefore, the technique for solving such restriction and increasing productivity is required strongly.

If a simple means to solve these problems at once can be found out from the different viewpoint from the conventional method, it becomes very useful.

The present invention has the object to provide the sleeve for the press roll capable of preventing the damage to the corrugation roll and the press roll by externally mounting the sleeve having the specific structure on the press roll for the corrugator and protecting the surface of said press roll. The sleeve is also capable of reducing the noise and the vibration remarkably, preventing the press mark on the liner surface of the corrugated cardboard, not generating trouble in the production of the corrugated cardboard since the sleeve can be demounted and mounted easily even when said sleeve is damaged, and increasing the speed for producing the corrugated cardboard to more than the conventional speed limit. In addition the

present invention also has the object to provide the press roll mounted with said sleeve.

Summary of the Invention

The sleeve for the press roll of the present invention is a cylindrical sleeve (1) to be used by externally mounting on a press roll (2), and is characterized in that the cylindrical sleeve (1) comprises a cylindrical main layer (11) composed with a composite material, where a fiber reinforcing material is bound with a matrix resin. In this case, it is available that the first cover layer (12) is formed on an outer peripheral surface of the main layer (11), the second cover layer (13) is formed on an inner circumference surface of the main layer (11), and a cushion layer (14) (or the third cover layer (15) and the cushion layer (14)) is formed between the main layer (11) and the second cover layer (13).

The press roll mounted with the sleeve of the present invention has the characteristics that the cylindrical sleeve (1) to be used by externally mounting on the press roll (2) is externally mounted in a non-fixed state on the press roll (2), and that said cylindrical sleeve (1) comprises the cylindrical main layer (11) composed with the composite material, where a fiber reinforcing material is bound with a

matrix resin.

In the present invention, said cylindrical sleeve (1) having the specific structure is externally mounted in a non-fixed state on the press roll (2).

Therefore, when the press roll mounted with the sleeve of the present invention is used in a hard condition, such as the corrugator, it is possible to prevent the damage to the corrugation roll and the press roll, reduce the noise and the vibration remarkably, and prevent the press mark on the liner surface of the corrugated cardboard.

When the sleeve is damaged, the production of the corrugated cardboard is not disturbed since the sleeve can be demounted and mounted easily.

When the cushion layer (14) is formed, since the pressing time for bonding the corrugated medium with the liner becomes long, the enough bonding can be realized even when the rotational speed of the corrugation roll and the press roll is high. Therefore, the production speed of the corrugated cardboard can be increased as compared with that of the conventional process, so that the productivity can be increased.

BRIEF EXPLANATION OF THE DRAWINGS

Figure 1 is a typical perspective view showing an example of the skeleton with the fiber reinforcing

material in the main layer (11) of the cylindrical sleeve (1).

Figure 2 is a typical cross sectional view in the circumferential direction, showing the skeleton with the fiber reinforcing material in Figure 1 in the case of the monolayer.

Figure 3 is a typical cross sectional view in the circumferential direction, showing an example of the cylindrical sleeve (1).

Figure 4 is a typical cross sectional view in the circumferential direction, showing an example of the cylindrical sleeve (1).

Figure 5 is a typical cross sectional view in the circumferential direction, showing an example of the cylindrical sleeve (1).

Figure 6 is a typical cross sectional view in the circumferential direction, showing an example of the cylindrical sleeve (1).

Figure 7 is a typical cross sectional view in the circumferential direction, showing an example of the cylindrical sleeve (1).

Figure 8 is a typical view showing an example of the corrugator for manufacturing the corrugated cardboard.

Figure 9 is a front view of the press roll (2)

externally mounted with the sleeve (1).

Figure 10 is a cross sectional view showing an other example of the press roll (2) externally mounted with the sleeve (1).

Figure 11 is a cross sectional view showing an other example of the press roll (2) externally mounted with the sleeve (1).

Figure 12 is a cross sectional view showing an other example of the press roll (2) externally mounted with the sleeve (1).

Figure 13 is a cross sectional view showing further another example of the press roll (2) externally mounted with the sleeve (1).

Explanation of codes

(1) is a sleeve,

(11) is a main layer,

(12) is the first cover layer,

(13) is the second cover layer,

(14) is a cushion layer,

(15) is the third cover layer,

(2) is a press roll,

(2a) is a flange,

(2b) is a slit groove,

(3) is a corrugation roll,

(4) is a pasting device,

(5) is a finger,

(6) is a guide roll,

(7) is an auxiliary roll,

(M) is a corrugating medium,

(L) is a liner, and

(P) is a contacted point of the press roll (2) with the corrugation roll (3).

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Hereinafter, the present invention will be explained more concretely.

<Sleeve for Press Roll>

(The layer composition of the sleeve (1))

The sleeve for the press roll of the present invention is the cylindrical sleeve (1) to be used by externally mounting on the press roll (2) made with the metal.

Said cylindrical sleeve (1) comprises the main layer (11) composed with the composite material, where the fiber reinforcing material is bound with the matrix resin.

It is preferable that the first cover layer (12) is formed on the outer periphery surface of the cylindrical main layer (11). It is also preferable that the second cover layer (13) is formed at the side of the inner surface of the cylindrical main layer (11).

Moreover, it is preferable that the cushion layer (14) is formed between the main layer (11) and the second cover layer (13), or the third cover layer (15) and the cushion layer (14) are formed between the main layer (11) and the second cover layer (13) in this order.

That is, the cylindrical sleeve (1) can comprise as follows.

1. The main layer (11).
2. The first cover layer (12) / the main layer (11).
3. The first cover layer (12) / the main layer (11) / the second cover layer (13).
4. The first cover layer (12) / the main layer (11) / the cushion layer (14) / the second cover layer (13).
5. The first cover layer (12) / the main layer (11) / the third cover layer (15) / the cushion layer (14) / the second cover layer (13).
6. The main layer (11) / the second cover layer (13).
7. The main layer (11) / the cushion layer (14) / the second cover layer.
8. The main layer(11) / the third cover layer (15) / the cushion layer (14) / the second cover layer (13).

In addition, if the meaning of the present invention may not be lost, there are no problems that the other layer is added further if necessary.

(Main layer (11))

The main layer (11) has the cylindrical form, and comprises the composite material, where the fiber reinforcing material is bound with the matrix resin.

As the matrix resin, a thermosetting resin or a curable resin, such as an epoxy resin, an unsaturated polyester resin, a vinyl ester resin, a polyimide resin, a phenol resin, a melamine resin, an urea resin, a furan resin, a silicon-base resin, a polyurethane resin, a bismaleimide resin or an oxazoleine resin, can be used. Especially, the epoxy resin is important, and the unsaturated polyester resin is also important.

As the matrix resin other than the above resins, various thermoplastic resins, such as a fluororesin, a polyamide resin, a polycarbonate resin, a polypropylene resins, a polyethylene resins, a polyacetal resins, a polystyrene resins, an ABS resin, a methacrylic resin, polybutylene terephthalate resins, a polyphenylene ether resins resins, a polyphenylene sulfide resins, a polysulfone resins, a polyether-ether ketone resins, can be used.

As the fiber reinforcing material, an inorganic, carbonaceous or organic fiber, such as a carbon fiber, a boron fiber, an alumina fiber, a silica fiber, a silicon carbide fiber, a glass fiber, a metal fiber,

a poly-paraphenylene-benzobisoxazole fiber, an aramid fiber, a polybenzimidazole fiber, a polyether-ether ketone fiber, a polyamideimide fiber, a polyimide fiber, a liquid crystal polyester fiber, a fluororesin fiber, an ultra-high molecular weight polyethylene fiber, a polyolefin fiber, a polyester fiber, a polyamide fiber, an acrylic fiber or a vinylon fiber, can be used. Various whiskers can be also used. It is preferable that the fiber reinforcing materials is selected from the materials having the required strength and heat resistance, for example, more than 180 degree C, preferably more than 200 degree C.

In the case that the sleeve (1) is externally mounted on the press roll of the corrugator, it is desirable that at least a part of the fiber reinforcing materials in the main layer (11) comprises the material having high heat conductivity, such as the carbon fiber or the metal fiber, especially, a copper wire.

It is preferable that the fiber reinforcing material is subjected to the surface treatment, such as a borane treatment, a silane treatment, an amino silane treatment, an ozone treatment, an oxygen oxidation treatment, a plasma treatment or an ultraviolet treatment, in accordance with the kind of the fiber reinforcing material.

It is especially preferable that said fiber reinforcing material is a roving made with a monofilament yarn or a multi-filament yarn, which are made with long fibers, a continuous strand mat, a roving cloth, a yarn, a mat, a blind-like roving or the like. The materials, where the suitable number of these yarns is made into a cord by paralleling or twisting and further reparalleling or retwisting, or made into a braid using these cords, can be used preferably. Moreover, a spun yarn, a woolen yarn, a covered yarn, where the other yarn or a slit yarn is helically wound on the periphery of a core yarn, a film split yarn, split resin yarn or the like, can be also used.

It is available that the fiber reinforcing material in the cylindrical main layer (11) has one layer (mono-layer) or a multi-layer (more than two layers). It is available that the fiber reinforcing material in each layer is formed in the cylindrical form being seamless, i.e., there is no seam, by a hollow-weave method or a circular-knitting method, or is formed finally in the cylindrical shape by winding the fiber reinforcing material having the linear or sheet shape.

As for each layer, it is preferable that the fiber

reinforcing material is the material, where a main skeleton is made by line running in the length direction of the cylinder, i.e., for example, the main line runs and is arranged in the state like as a blind in the length direction of the cylinder, or the material, where the main skeleton is made by line running in a circumferential direction of the cylinder, i.e., for example, the main linear is helically wound and arranged in the circumferential direction of the cylinder. A sub line runs and is arranged in the other directions, i.e., a orthogonal direction, a inclined direction, or random directions, to the main line. Furthermore, it is available that the main line runs in an inclined direction of the cylinder.

When the fiber reinforcing material is formed in each of the multi-layer, it is preferable that the running direction of the main line is changed in each layer.

As the method for forming the cylindrical main layer (11), the following methods can be used. One method is that the matrix resin is impregnated or infiltrated after the cylinder having been formed with the fiber reinforcing material. Another method is that the cylinder is formed while coating, impregnating or infiltrating the matrix resin to the fiber reinforcing

material. In this case, a surface resin can be coated beforehand on a mold for forming the cylinder.

In addition, the following various forming methods being applicable for forming the fiber reinforcing resin can be also used as additional methods. That is, the method comprising, impregnating and laminating the fiber reinforcing material with the matrix resin or using a prepreg on the mold, covering the fiber reinforcing material with a film, decompressing the laminated surface to fit the film, and pressurizing the laminated surface to defoam, the method comprising, impregnating and laminating the fiber reinforcing material with the matrix resin or using a prepreg on the mold, covering the mold with a bag, pressurizing and heating the whole including the mold in a steam autoclave, the method comprising, setting the fiber reinforcing material in the mold, casting the matrix resin in the mold, and closing the mold to solidify, the method comprising, putting the fiber reinforcing material on the mold, and sucking up or injecting the matrix resin, the method comprising, forming the cylinder by using the prepreg consisting of the fiber reinforcing material impregnated with the matrix resin, or the method comprising, forming the cylinder by spraying the chopped fiber reinforcing

material, in which an electrostatic coating can be applied.

(First cover layer (12))

The first cover layer (12) is the layer formed on the outer peripheral surface of the cylindrical main layer (11). It is preferable that the first cover layer (12) also comprises the composite material, where the fiber reinforcing material is bound with the matrix resin. At this time, as the matrix resin and the fiber reinforcing material, the same materials described in the explanation of the main layer (11) can be used. It is desirable that at least a part of the fiber reinforcing material is selected from the material having the required heat resistance with the required strength.

It is preferable that the fiber reinforcing material composing the first cover layer (12) has a entangled line body, such as a nonwoven fabric, a woven fabric or a knitted fabric, in many cases.

The first cover layer (12) composes an outermost layer of the sleeve (1), and preserves the main layer (11). So, said first cover layer (12) is designed in many cases so as to have some effective properties, such as frictional resistance, lubricating properties, heat resistance, surface smoothness, prevention of

paste adhesion or the like, by selecting the material or polishing the outer peripheral surface.

(Second cover layer (13))

The second cover layer (13) is the layer formed on the inner circumference surface of the cylindrical main layer (11). It is preferable that the fiber reinforcing material composing the second cover layer (13) has a entangled line body, such as the linear fabric, the nonwoven fabric, the woven fabric or the knitted fabric, in many cases. The second cover layer (13) is positioned at the innermost of the sleeve (1), and preserves the main layer (11), so that the requirement for strength is not so severe.

It is preferable that said second cover layer (13) also comprises the composite material, where the fiber reinforcing material is bound with the matrix resin. At this time, as the matrix resin and the fiber reinforcing material, the same materials described in the explanation of the main layer (11) can be used. It is desirable that at least a part of the fiber reinforcing material comprises the material having the required heat resistance with the required strength.

The second cover layer (13) composes an innermost layer of the sleeve (1) and is contacted with the surface of the press roll (2). The sleeve (1) is

externally mounted in the non-fixed state on the press roll (2), so that it is desirable that the second cover layer (13) is formed so as to have good slidableness. Therefore, it is desirable that the second cover layer (13) formed with the entangled line body is formed to have good slidableness, for example, by comprising the composite material, where the fiber reinforcing material is bound with the matrix resin blended with fluorine resin particles.

(Cushion layer (14))

The cushion layer (14) is formed between the cylindrical main layer (11) and the second cover layer (13) if necessary.

As the cushion layer (14), for example, a sheet layer, such as a rubber elastomer having heat resistance or a foam layer having heat resistance, can be used.

(Third cover layer (15))

The third cover layer (15) is formed between the main layer (11) and the cushion layer (14) if necessary, when the cushion layer (14) is formed between the cylindrical main layer (11) and the second cover layer (13) as described above.

It is preferable that the third cover layer (15) also comprises the composite material, where the fiber

reinforcing material is bound with the matrix resin. At this time, as the matrix resin and the fiber reinforcing material, the same materials described in the explanation of the main layer (11) can be used. It is desirable that at least a part of the fiber reinforcing material comprises the material having the required heat resistance with the required strength. (Main layer (11), First cover layer (12), Second cover layer (13), Third cover layer (15))

It is available that the main layer (11), the first cover layer (12), the second cover layer (13) and the third cover layer (15) are formed respectively, to form the cylindrical sleeve (1) comprising various layers described above. However, when these layers are formed one by one, it becomes that the whole is regarded as the main layer (11) since the distinction of each layer becomes not certainly. But, in the present invention, there are no problems in such a case, and rather, said case is more desirable.

(Surface hardness and stiffness of sleeve (1))

It is preferable that at least the surface of the outermost layer of each layer composing the sleeve (1) has more than a certain hardness which is, for example, more than 70 degrees, preferably about 70 to 85 degrees. Moreover, it is also preferable that whole of the

sleeve (1) is composed as stiff as possible.

(Sleeve mounting press roll)

As for the sleeve mounted press roll of the present invention, the sleeve (1) for the press roll is externally mounted in the non-fixed state on the press roll (2). The reason why said sleeve (1) is externally mounted in the non-fixed state is that the sleeve (1) can be mounted and demounted easily to the press roll (2).

As the press roll (2), various press rolls can be used. For example, the press roll for feeding the paper, sheet, web or the like, which are wound in a roll state, without generating looseness, or the press roll for a cutting device slitting said paper, sheet, web or the like continuously while feeding them, is used. However, the case of the press roll of the corrugator, which is the device for manufacturing the corrugated cardboard, is especially important.

It is preferable that a regulating means (2a) for regulating the move in an axial direction of the sleeve (1) externally mounted thereon is provided at the press roll (2). An example of the regulating means (2a) is a flange.

The press roll (2) is made with the metal in general. However, in the present invention, the roll

having elasticity also can be used as the press roll (2). An example of such roll is a press roll made with fluororubber having heat resistance. When the roll having elasticity is used as the press roll (2), and the above described sleeve (1) having high surface hardness of the outermost layer is externally mounted on said roll, it is possible to paste the corrugated medium with the liner certainly at high speed without biting of the corrugation roll into the press roll (2), and prevent the generation of the noise effectively.

The press roll (2) is a fixed or rotational roll and it is available that a fluid such as air can be fed into the space between said press roll (2) and the sleeve (1) externally mounted on it. At this time, the sleeve (1) can be rotated freely to the press roll (2) through the fluid.

In this way, in the case that the press roll (2) is a fixed or rotational roll and the fluid can be fed into the space between said press roll (2) and the sleeve (1) externally mounted on said press roll (2), when said press roll (2) is used as the press roll pressing toward the corrugation roll (3) of the corrugator, the following trouble is generated occasionally. That is, the fluid fed into the space between the press roll (2) and the sleeve (1)

externally mounted on it, is escaped from the pressed position by the pressure at the contacted position (P), so that the cushion effect by the fluid cannot be obtained sufficiently.

Therefore, in the case that such trouble may be generated, it is preferable that the auxiliary rolls (7) and (7) are provided at the outer peripheral side of the press roll (2) and the both sides of the contacted position (P), where the press roll (2) is contacted with the corrugation roll (3). These auxiliary rolls can suppress the fluid fed into the space between said press roll (2) and the sleeve (1) to escape from the pressed position by the pressure in the contacted position (P).

Example

Next, the present invention will be explained concretely with examples.

Example 1

Figure 1 is a typical perspective view showing an example of the skeleton with the fiber reinforcing material in the main layer (11) of the cylindrical sleeve (1). In Figure 1, the sleeve (1) has the composition that the fiber reinforcing material is woven like a blind to make the running direction of the fiber into the cylinder length direction. For

making the main line run in the cylinder length direction, a blind weaving method, a hollow-weaving method, a reeling weaving method or the like, which uses the main line as a warp yarn and the sub line as a weft yarn, can be used as a weaving method. In addition, it is preferable that a knitted fabric is used other than a woven fabric. For example, when the knitted fabric is used by a circular knitting method, it is possible to obtain the cylindrical skeleton extending and contracting in the diameter direction and the length direction.

Figure 2 is a typical cross sectional view of the circumferential direction of the skeleton with the fiber reinforcing material, and shows the case of the monolayer. In Figure 2, a black circle, a white circle and a circle added with scattered dots show different kinds of the fiber reinforcing material. They are, for example, fibrous materials, which is the linear material, the paralleled material, the twisted material, the retwisted material or the like, selected from the carbon fiber, the polyparaphenylenebenzobisoxazole fiber, the aramid fiber, the copper wire or the like. It is preferable that at least a part of the fiber reinforcing material comprises the material having high heat conductivity

(shown as the black circle), such as the copper wire, carbon fiber or the like. Moreover, it is also preferable that at least a part of the fibrous material comprises the twisted material or the retwisted material (shown as the circle added with scattered dots), which are combined with the fibrous material having high heat conductivity.

From Figure 3 to Figure 7 are typical cross sectional views in the circumferential direction, showing examples of the cylindrical sleeve (1). The figures from Figure 3 to Figure 7 have following layer compositions. In all of the compositions, each layer is integrally formed with the used matrix resin so as not to cause the delamination between the layers. In these figures, the matrix resin is shown with hatching.

Figure 3 : main layer (11)

Figure 4 : the first cover layer (12) / main layer (11)

Figure 5 : the first cover layer (12) / main layer (11) / the second cover layer (13)

Figure 6 : the first cover layer (12) / main layer (11) / cushion layer (14) / the second cover layer (13)

Figure 7 : the first cover layer (12) / main layer (11) / the third cover layer (15) / cushion layer (14) / the second cover layer (13)

The main layer (11) is composed with the composite material comprising the fiber reinforcing material, where the epoxy resin or the unsaturated polyester resin is used as the matrix resin in Figure 1.

The first cover layer (12) and the third cover layer (15) is composed with the composite material comprising the non-woven fiber reinforcing material, where the fibrous material having high heat conductivity is used in a part, i.e., the same material as that of the main layer (11), and the epoxy resin or the unsaturated polyester resin as the matrix resin.

The second cover layer (13) is composed with the composite material comprising the non-woven fiber reinforcing material, where the fibrous material having high heat conductivity is used in a part, i.e., the same material is used as that of the main layer (11), and the epoxy resin or the unsaturated polyester resin, which are blended with the fluororesin particles, i.e., polytetrafluoroethylene particles, as the matrix resin.

As for hardening of matrix resins in the main layer (11), the first cover layer (12), the second cover layer (13) and the third cover layer (15), when the epoxy resin is used, said resin is hardened by heating, and when the unsaturated polyester resin is

used, said resin is hardened at room temperature or by heating.

The cushion layer (14) is composed with the sheet layer of the rubber elastomer having heat resistance.

The cylindrical sleeve (1) comprising the above-described layers is composed in stiffness, and its surface hardness of the outermost layer is about 70 to 85 degree.

Figure 8 is a typical view showing an example of the corrugator for manufacturing the corrugated cardboard. (3) and (3) are a pair of corrugation rolls, (4) is a pasting device, (5) is a finger, (6) and (6) are guide rolls, (M) is a corrugating medium, and (L) is a liner. In the actual device, a liner pre-heater, a corrugating medium pre-heater, a rolling-up roll or the like are positioned.

Figure 9 is a front view of the press roll (2) externally mounted with the sleeve (1). The press roll (2) has the flange (2a) as shown in the figure, to prevent the move in the axial direction of the sleeve (1) externally mounted in the non-fixed state.

Example 2

In the example 1, the main layer (11) of the cylindrical sleeve (11) has the composition that the fiber reinforcing material is woven in the state like

a blind to make the running direction of the fiber into the cylinder length direction. However, in Example 2, the cylindrical form is formed by using the prepreg, which is infiltrated the fiber reinforcing material with the matrix resin and primary hardened, and winding the prepreg, around the first layer, the second layer, and the n layer, where the each winding direction is different. As for layers other than the main layer (11), the cylindrical sleeve having the structure according to the figure 3 to the figure 7 is produced like Example 1.

Example 3

In Example 3, the fluororubber roll having elasticity and excellent heat resistance is used as the press roll (2). When the above-described sleeve (1) having the high surface hardness of the outermost layer is externally mounted, it is possible to paste the corrugating medium with the liner certainly at high speed without biting the press roll (2) to the corrugation roll, and to prevent the generation of the noise effectively.

From Example 4 to Example 6

Figures 10, 11, and 12 are cross sectional views showing other examples of the press roll (2) externally mounted with the sleeve (1).

In Figure 10, numerous small holes are formed on the rotational press roll (2) made with the metal. The air fed into the press roll (2) is led out from the small hole to the space between the press roll (2) and the sleeve (1), to have an air cushion effect.

In Figure 11, numerous small holes are formed on the fixed press roll (2) made with the metal. The air fed into the press roll (2) is led out from the small hole to the space between the press roll (2) and the sleeve (1), to have an air cushion effect. The (2b) in Figure 11 is slit grooves for leading the air.

In Figure 12, numerous small holes are formed on the fixed press roll (2) made with the metal. The air fed into the press roll (2) is led out from the small hole to the space between the press roll (2) and the sleeve (1), to have the air cushion effect.

Example 7

Figure 13 is a cross sectional view showing further another example of the press roll (2) externally mounted with the sleeve (1).

In Example 7, the auxiliary rolls (7) and (7) are provided at the both sides of a contacted position (P) in Figure 10 or 11, where the press roll (2) is contacted with the corrugation roll (3). These auxiliary rolls can suppress the fluid fed into the

space between the press roll (2) and the sleeve (1) externally mounted on the press roll (2), to escape from the press point.

The above described sleeve mounted press roll is useful as various press rolls, for example, the press roll feeding the paper, sheet, web or the like, which are wound in the roll form, without generating looseness, or the press roll for a cutting device slitting said paper, sheet, web or the like continuously while feeding them. However, the sleeve mounted press roll is especially useful as the press roll of the corrugator being the corrugated cardboard manufacturing device.